

smaller amounts of nitrogen to be released over a longer period.

Root disorders caused by soil compaction, construction damage, or drought can be corrected by using fertilizers high in phosphorus which will promote new root growth. Superphosphate (0-20-0) or triple superphosphate (0-46-0) are recommended. High nitrogen fertilizers, particularly fast release forms, should be avoided because the resulting increased top growth will strain the already inadequate root system.

**When to Fertilize** – Normally, shade trees should be fertilized only enough to keep them healthy. In heavy soils or soils underlain by a hardpan, too frequent or too heavy fertilization may cause nutrients to build up to toxic levels. This may be avoided by periodic soil testing which will show abnormally high or low nutrient levels.

Usually, October through March are the best times to fertilize. Soil moisture and temperature conditions are best during these periods, and this will insure that the fertilizer will be in place at the beginning of the growing season when maximum benefit will be realized. Root growth is best during this time also. Late summer fertilization may promote late growth which is undesirable before winter.

Distressed trees should be fertilized at once. Stress problems will normally show up during the active growing season. Root damaged trees should be fertilized during periods of maximum root growth which occur during spring, early summer and in early to mid autumn.

**Where to Apply Fertilizer** – Fertilizer must be placed near the tree's absorbing roots. The absorbing roots begin several feet from the trunk and can extend beyond the spread of outermost branches by as much as 40 to 50%. Shallow-rooted species such as elm or maple typically have roots that extend well beyond the spread of the branches. In such cases, extend the area fertilized to match the estimated root spread.

**Application Methods** – The method selected will depend on the plant cover under the tree, soil conditions, and amount of time and labor available to fertilize the tree. The typical methods are discussed below.

**1) Drill Hole** – Holes are drilled or punched in the soil in the area to be fertilized. An auger, punch bar, or crowbar is used to make slightly slanted holes 12 to 15 inches deep

spaced about 3 feet apart. The recommended amount of fertilizer should then be distributed evenly among the holes. It is recommended to mix the fertilizer with peat moss, pine bark, or gravel to backfill the holes. A funnel and a small can as a measuring device can be used to place the fertilizer/backfill into the holes. This technique has the advantage of aerating the soil as well as placing the fertilizer in close contact with the absorbing roots.

**2) Feeding Needles** – Several types of “needles” are available which inject liquid fertilizer solutions into soil. The addition of fertilizer in solution adds moisture to the soil, provides nutrients almost immediately since nutrients must be in solution before roots can absorb them, and provides more even distribution. Several types of liquid feeding needles are available commercially. In most types, a plant food cartridge is placed in a chamber and water is supplied by a garden hose in the ground at the proper depth. Needles do not work well in heavy soils at normal home water pressures. Avoid high nitrogen, water soluble plant food cartridges for root damaged trees.

**3) Surface** – The simplest and fastest way to apply fertilizer is to spread it on the lawn or soil surface under the branch spread. (Many horticulturists believe this method to be just as effective.) To prevent lawn or groundcover damage, the fertilizer should be applied in split applications with thorough watering after each application. One application of the recommended amount followed by thorough watering is sufficient on bare soil areas. Phosphorus, and to a lesser extent potassium, do not move well through soil; therefore, the fertilizer should be tilled or watered in thoroughly. Frequently, surface-fed trees develop shallow (sometimes above ground) root systems which interfere with mowing, adversely affect grass growth, and make the tree more drought susceptible.

**Application Rates for Deciduous Trees** – The rate of application will vary with the size of the tree. Two methods of determining fertilizer rates are commonly used for deciduous trees.

**1) Diameter of Trunk** – Apply 3 to 5 pounds of 10-6-4 (or similar analysis fertilizer) for each inch of trunk diameter measured at 4 and one-half feet above ground. For example, a 10-inch diameter tree required 30 to 50 pounds of 10-6-4 fertilizer. Diameters can be found by the following formula:

$$\text{Diameter} = \text{circumference} \times .318$$